

1 What is claimed is:

2 1. A mass spectrometer comprising:

3 an ionization source to produce ions;

4 a plurality of multipoles to cool, guide or select said
5 ions;

6 a collision surface for fragmenting said ions; and

7 a mass analyzer to analyze said ions.

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10 2. A mass spectrometer according to claim 1, wherein said
11 ionization source is selected from the group consisting of
12 electrospray ionization source, nanospray ionization source,
13 microspray ionization source, matrix assisted laser
14 desorption/ionization, electron ionization, chemical ionization
15 and electron ionization.

16 3. A mass spectrometer according to claim 1, wherein said
17 plurality of multipoles further comprise at least one quadrupole.

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1 4. A mass spectrometer according to claim 1, wherein a potential
2 is applied between said ionization source and said collision
3 surface to allow said ions to undergo surface induced
4 dissociation.

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6 5. A mass spectrometer according to claim 1, wherein said mass
7 analyzer is selected from the group consisting of time-of-flight
8 (TOF) mass analyzer, fourier transform ion cyclotron resonance
9 (FTICR) mass analyzer, quadrupole ion trap mass analyzer and
10 coaxial multiple reflection TOF mass analyzer.

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12 6. A mass spectrometer according to claim 1, wherein a potential
13 is applied between said ionization source and said collision
14 surface such that said ions pass through all of said multipoles
15 without colliding with said collision surface.

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17 7. A mass spectrometer according to claim 1, wherein said
18 plurality of multipoles comprise first, second and third
19 multipoles.

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1 8. A mass spectrometer according to claim 7, wherein at least
2 one of said first, second or third multipole comprises a
3 quadrupole.

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5 9. A mass spectrometer according to claim 7, wherein said first
6 and second multipoles are arranged coaxially.

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8 10. A mass spectrometer according to claim 7, wherein said
9 collision surface is positioned between said second and third
10 multipoles.

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12 11. A mass spectrometer according to claim 7, wherein said
13 collision surface is positioned at an angle to a co-axis of said
14 first and second multipoles.

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16 12. A mass spectrometer according to claim 7, wherein said first
17 multipole collisionally cools said ions.

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1 13. A mass spectrometer according to claim 7, wherein a
2 potential is applied between said ionization source and said
3 collision surface such that said ions pass through all of said
4 multipoles without colliding with said collision surface.
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6 14. A mass spectrometer according to claim 7, wherein said third
7 multipole contains a collision gas to fragment said ions.

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10 15. A mass spectrometer according to claim 7, wherein said first
11 multipole selects ions of a predetermined m/z range, wherein a
12 potential is applied between said ionization source and said
13 collision surface such that said selected ions will not collide
14 with said collision surface, and wherein said third multipole
15 contains a collision gas to fragment said selected ions.
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1 16. A mass spectrometer comprising:

2 an ionization source to produce ions;

3 first, second and third multipoles to cool, guide or
4 select said ions;

5 a collision surface for fragmenting said ions; and

6 a mass analyzer to analyze said ions;

7 wherein said first and second multipoles are arranged
8 coaxially;

9 wherein said collision surface is positioned between said
10 second and third multipoles; and

11 wherein said collision surface is positioned at an angle to
12 said axis of said first and second multipoles.

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14 17. A mass spectrometer according to claim 16, wherein at least
15 one of said first, second or third multipole comprises a
16 quadrupole.

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18 18. A mass spectrometer according to claim 16, wherein said
19 first and second multipoles are arranged coaxially.

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1 19. A mass spectrometer according to claim 16, wherein said
2 collision surface is positioned between said second and third
3 multipoles.

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5 20. A mass spectrometer according to claim 16, wherein said
6 collision surface is positioned at an angle to a co-axis of said
7 first and second multipoles.

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12 21. A mass spectrometer according to claim 16, wherein said
13 first multipole collisionally cools said ions.

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18 22. A mass spectrometer according to claim 16, wherein a
19 potential is applied between said ionization source and said
20 collision surface such that said ions pass through all of said
21 multipoles without colliding with said collision surface.

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23 23. A mass spectrometer according to claim 16, wherein said
24 third multipole contains a collision gas to fragment said ions.

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1 24. A mass spectrometer according to claim 16, wherein said
2 first multipole selects ions of a predetermined m/z range,
3 wherein a potential is applied between said ionization source and
4 said collision surface such that said selected ions will not
5 collide with said collision surface, and wherein said third
6 multipole contains a collision gas to fragment said selected
7 ions.

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9 25. A mass spectrometer according to claim 16, wherein said
10 ionization source is selected from the group consisting of
11 electrospray ionization source, nanospray ionization source,
12 microspray ionization source, matrix assisted laser
13 desorption/ionization, chemical ionization and electron
14 ionization.

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1 26. A mass spectrometer comprising:
2 at least one sample;
3 a source of laser radiation for producing ions from
4 said sample;
5 a plurality of multipoles to cool and guide said ions;
6 and
7 a mass analyzer to analyze said ions.

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9 27. A mass spectrometer according to claim 26, wherein said
10 ionization source is selected from the group consisting of
11 electrospray ionization source, nanospray ionization source,
12 microspray ionization source, matrix assisted laser
13 desorption/ionization, chemical ionization and electron
14 ionization.

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16 28. A mass spectrometer according to claim 26, wherein said
17 plurality of multipoles further comprise at least one quadrupole.

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1 29. A mass spectrometer according to claim 26, wherein said mass
2 analyzer is selected from the group consisting of time-of-flight
3 (TOF) mass analyzer, fourier transform ion cyclotron resonance
4 (FTICR) mass analyzer, quadrupole ion trap mass analyzer and
5 coaxial multiple reflection TOF mass analyzer.

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7 30. A mass spectrometer according to claim 26, wherein said
8 plurality of multipoles comprise first, second and third
9 multipoles.

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11 31. A mass spectrometer according to claim 30, wherein at least
12 one of said first, second or third multipole comprises a
13 quadrupole.

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15 32. A mass spectrometer according to claim 30, wherein said
16 first and second multipoles are arranged coaxially.

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18 33. A mass spectrometer according to claim 30, wherein said
19 MALDI sample is positioned between said second and third
20 multipoles.

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1 34. A mass spectrometer according to claim 30, wherein said
2 MALDI sample is positioned at an angle to a co-axis of said first
3 and second multipoles.

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5 35. A mass spectrometer according to claim 30, wherein said
6 third multipole contains a collision gas to fragment said ions.

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8 36. A Q-SID-Q-TOF mass spectrometer comprising:
9 an ionization source to produce ions;
10 a plurality of multipoles comprising at least one
11 quadrupole;
12 a collision surface for fragmenting said ions; and
13 a time-of-flight mass analyzer to analyze said
14 fragmented ions.

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16 37. A Q-SID-Q-TOF mass spectrometer according to claim 36,
17 wherein said ionization source is selected from the group
18 consisting of electrospray ionization source, nanospray
19 ionization source, microspray ionization source, matrix assisted
20 laser desorption/ionization, chemical ionization and electron
21 ionization.

1 38. A Q-SID-Q-TOF mass spectrometer according to claim 36,
2 wherein a potential is applied between said ionization source and
3 said collision surface to allow said ions to undergo surface
4 induced dissociation.

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6 39. A Q-SID-Q-TOF mass spectrometer according to claim 36,
7 wherein a potential is applied between said ionization source and
8 said collision surface such that said ions pass through all of
9 said multipoles without colliding with said collision surface.

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11 40. A Q-SID-Q-TOF mass spectrometer according to claim 36,
12 wherein said plurality of multipoles comprise one quadrupole and
13 first and second multipoles.

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15 41. A Q-SID-Q-TOF mass spectrometer according to claim 40,
16 wherein said first multipole and said quadrupole are arranged
17 coaxially.

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19 42. A Q-SID-Q-TOF mass spectrometer according to claim 40,
20 wherein said collision surface is positioned between said
21 quadrupole and said second multipole.

1 43. A Q-SID-Q-TOF mass spectrometer according to claim 40,
2 wherein said collision surface is positioned at an angle to a
3 co-axis of said first multipole and said quadrupole.

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5 44. A Q-SID-Q-TOF mass spectrometer according to claim 40,
6 wherein said second multipole comprises a collision gas cell for
7 collisionally cooling said fragmented ions.

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9 45. A Q-SID-Q-TOF mass spectrometer according to claim 40,
10 wherein said first multipole collisionally cools said ions.

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12 46. A Q-SID-Q-TOF mass spectrometer according to claim 40,
13 wherein a potential is applied between said ionization source and
14 said collision surface such that said ions pass through all of
15 said multipoles without colliding with said collision surface.

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17 47. A Q-SID-Q-TOF mass spectrometer according to claim 40,
18 wherein said second multipole contains a collision gas to
19 fragment said ions.

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1 48. A Q-SID-Q-TOF mass spectrometer according to claim 40,
2 wherein said first multipole selects ions of a predetermined m/z
3 range, wherein a potential is applied between said ionization
4 source and said collision surface such that said selected ions
5 will not collide with said collision surface, and wherein said
6 second multipole contains a collision gas to fragment said
7 selected ions.

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